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contrary, derived from the south-east winds coming from the Mexican Gulf, but which are also drained by passing over the elevated plains 4,000 feet high, and the eastern mountain chains along the Rio Grande, and thus have but little residual moisture to deposit; hence the whole of this district, from north to south, suffers from deficient supply of rain, and is to be classed with the uncultivable land at the eastern base of the Rocky Mountains. Hence, for all practical purposes of agriculture and civilization, this continent, from long. 100° to the base of the Cascades and Sierra Nevada, is unfitted for the support of man, except in some favored valleys, or at the base of the mountain chains.

THE COLORADO EXPEDITION.

THE COLORADO OF THE WEST AND THE COUNTRY BORDERING IT—THE GRAND CANON.

During the past year a careful examination of the lower Colorado, for the purpose of ascertaining its capabilities for navigation by steamboats, was made by Lieut. Ives, of the United States Topographical Corps. As everything connected with the region described in his Report of the expedition, possesses great interest, both in a scientific and commercial point of view, and as the report contains valuable information never before made public, a portion of it is herewith inserted. The steamer used by the exploring party was a small iron vessel, constructed at the mouth of the river. The ascent was commenced on the 31st December, and is thus described by Lieut. Ives:

I continued up the river for five hundred miles, reaching, on the 11th of March, in lat. $36^{\circ} 6'$, the mouth of a stream supposed to be Rio Virgen, beyond which it was impracticable to proceed in boats. I therefore sent back the steamboat and the hydrographic party to Fort Yuma, and taking advantage of the permission granted in the instructions from the Department, left the river on the 23d of March, with a pack train, to examine, as far as possible, the country through which the Upper Colorado and its tributaries flow.

Keeping as near as possible to the river, I traversed the region along the 36th parallel, the greater portion of which had been previously unexplored. Most of the line of the 35th parallel was also visited. Following various lines of examination, gradually conducting towards the east, I arrived, about the 1st of June, at Albuquerque, on the Rio Grande—the distance accomplished during the land explorations amounting to nearly nine hundred miles. At Albuquerque the expedition was broken up—a few members of the party still retained—returning home by the overland route to Fort Leavenworth.

During the progress of my work upon the navigable portion of the Colorado, the water happened to be, according to the evidence of those who had lived in that vicinity for many years, unprecedently low. An opportunity was thus afforded of trying the experiment of steam navigation at the worst stage of the river, and at a time when the difficulties ordinarily to be encountered would be considerably magnified.

The region at the mouth of the Colorado is a flat expanse of mud. The lines of the shore and the channels that afford entrances to vessels from the Gulf, are shifting and changeable, and bars, shoals, and islands, composed of a semi-fluid mass, are in constant progress of formation and removal. The navigation for thirty miles above is rendered periodically dangerous by the strength and magnitude of the Spring tides. They have a rise and fall of from 25 to 30 feet, and a flow of extraordinary velocity. The flood is preceded by a "bore" or huge tide-wave, from four to seven feet high. In certain narrow bends it is very powerful and violent, but gradually loses its force as it ascends, and at a distance of thirty miles is scarcely perceptible. Along wider portions of the river are curves of the shore in which its force is not felt, and here boats may be safely moored till this dangerous wave has rolled by. Upon the shoals are formed what are called "tide-rips," where the sudden check given to the rushing volume of water causes it to bound along in high successive waves. Steamboats that come to the mouth of the river during the spring tides must ascend above tide-water during the ebb, and start to return two or three hours after the commencement of the flood.

The neap tides have a rise and fall of only ten feet, and a moderate velocity.

Between tide-water and Fort Yuma, the principal obstructions to navigation are the sand bars. These become more frequent and difficult as the river is ascended. The channel is exceedingly circuitous and continually changing.

The average depth is about eight feet. Shoals were frequently encountered, however, where there was scarcely two feet of water. Experience alone can afford the capability of navigating this portion of the river successfully. A knowledge of the locality of the channel cannot be imparted, as it has been known to shift from one bank to the opposite one in a single night. From the formation of the banks, from the appearance of the water, of the eddies, of pieces of drift wood, and other floating substances, and of the islands and bars visible above the surface, a practiced eye can do much towards selecting the proper course; though boats rarely make a trip between tide-water and Fort Yuma, at the low stage of the river, without grounding many times a day. The bars, however, are composed of soft and loose material, and may always be passed with more or less labor, depending, in a great measure, upon the skill shown in the employment of the different methods of extrication resorted to.

Below Fort Yuma there are no rocks. The snags are numerous, but seldom dangerous.

During the months of April, May and June, while the river is rising, and before new bars have had time to form, the navigation is most easy. The average velocity of the current at low water is two and a half miles an hour—during the July freshet, from five to six. The river at this season is about ten feet higher than during the winter months.

For three or four years an enterprising company has been engaged in transporting Government stores, in steamboats, from the mouth of the Colorado to Fort Yuma, and their persevering energy has so far succeeded in overcoming the natural difficulties of the navigation as to enable them now to perform their trips with entire regularity and certainty.

For one hundred and eighty miles above Fort Yuma the navigation has a character similar to that already described. The river passes through several chains of hills and mountains, forming gorges or canons, sometimes of considerable size, and in these there is generally a better channel than in the valleys.

During the next one hundred miles gravelly bars are of frequent occurrence, and at some of them the stream presents almost the appearance of a rapid. In the interval between, in both valleys and canons, are stretches of good river, and, although the bad places are worse, the channel generally is better than it is below.

For the succeeding fifty miles the river-bed is composed, in a great measure, of coarse gravel and stones, and many swift rapids were encountered. Upon several were found not over

two feet of water. In this portion of the river there are a few sunken rocks that would be dangerous till their position became known.

The "Black Canon," which is twenty-five miles in extent, is now reached, and in it the rapids are numerous and difficult.

Above the Canon the river is wide and shallow, and assumes the character of a rapid for so long a distance as to render any attempts to carry boats to a higher point almost valueless; and considering the difficulty, hazard and expense that would be incurred, at the low stage of water, in taking steamboats through the Canon, I am of opinion that its mouth should be considered the practical head of navigation. Up to this point the Colorado, notwithstanding the difficulties to be encountered, may be pronounced navigable. The experiment was attempted, as has been stated, at a time when the river had experienced an unprecedented fall. At most seasons of the year the navigation would be much easier and better, and a boat of suitable model and dimensions, and drawing, when loaded, but two feet, would be able to ascend the Colorado to the mouth of the "Black Canon" with as much regularity and certainty as the steamboats now upon the river ply between the head of the Gulf and Fort Yuma. Although, during high water, the river experiences a great rise, the whole channel is not proportionately deepened. New bars commence at once to form, and at all seasons shoals are liable to be encountered. An iron stern-wheel steamer, 100 feet long and of 22 feet beam, built full and with a perfectly flat bottom, having a large boiler, and powerful high-pressure engine, and drawing, when light, but 12 inches, would be the description of boat best adapted to the service.

Wood of excellent quality, for the purpose of fuel, can be obtained in abundance on the bank, at short intervals, between the mouth of the river and a point fifteen miles below the mouth of the Black Canon. It is principally mezquite, willow and cottonwood.

A reconnoissance, made from the foot of the Black Canon towards the nearest point on the emigrant road to Utah, showed that a wagon-road might be opened between the trail and the head of navigation. For sixteen miles, while passing through the gravel hills and ravines that cover the eastern slope of the intervening range of mountains, the country is somewhat rough, and a little work would be required to make a good roadway, but, after reaching the summit, there would be no further difficulty. The distance from the river to the emigrant road is about forty miles.

The navigable portion of the Colorado runs nearly north and south. Near the Gulf the surface on either side is perfectly unbroken; the view being limited towards the west by distant spurs from the mountains of Lower California, and towards the east by the great Sonora desert. Further north broad valleys alternate with wild and rugged ranges of mountains of volcanic origin, that cross the river in almost parallel north-west and south-east lines. The canons formed by the passage of the river through some of these mountain chains are probably unequalled in beauty and grandeur by any similar formations.

In the Black Canon, the deep and narrow current flows between massive walls of rock that rise sheer from the water for over a thousand feet, seeming almost to meet the dizzy height above. The tortuous course of the river, as it winds through these sombre depths, where the rays of the sun rarely penetrate, gives infinite variety to the majestic outlines of the overhanging masses, forming combinations whose colossal proportions and fantastic sublimity it would be impossible to figure or describe.

Above the Canon, in the vicinity of the mouth of the Virgen, is the most rugged and sterile region that I have ever beheld. Barren piles of rock, heaped together in chaotic disorder, and exhibiting on their broad surfaces no trace of vegetation, extend for miles in almost every direction. The volcanic upheavals, which have here their northern limit, appear to have experienced also their most violent action. Beyond, towards the north and east, the country is undisturbed, and a region is entered upon that presents totally new features and peculiarities.

This is a vast table-land, hundreds of miles in breadth, extending eastward to the mountains of the Sierra Madre, and stretching far north into Utah. To the extreme limit of vision immense plateaus rise, one above the other, in successive steps, the floors of the most elevated being from seven to eight thousand feet above the level of the sea. The Colorado and its tributaries, seeking the level of the low region to the south-west, have, by ages of wear and abrasion, cut their way through this huge formation, making canons that are in some places *more than a mile in depth*. The mighty avenues of the main water-courses are the thoroughfares into which smaller but still giant chasms debouch, and these in turn have their own subordinate tributaries, forming a maze of yawning abysses, generally inaccessible, and whose intricacies it would be a hopeless task to attempt to unravel. Twice only, after long

and difficult clambering down the sides of the precipices, and through walled approaches that seemed to be leading into the bowels of the earth, were the banks of the streams below finally attained. One place was on the Colorado itself, and the other near the mouth of one of its larger tributaries. Except at the place of descent, the canon of the river, as far as it could be seen, showed no place of practicable ingress or outlet, and the appearance of the torrent, foaming and surging along its confined bed, left little room for doubt as to what would be the result of any attempt, such as has been sometimes suggested, to explore the river in boats from its sources above.

So numerous and so closely interlaced are the canons in some portions of this singular region, that they have displaced all but scattered remnants of the original plateau, leaving narrow walls, isolated ridges, and spires so slender that they seem to totter upon their basis, shooting up to an enormous height from the vaults below.

The natural surface of the country opposes insurmountable barriers to traveling in any fixed direction, and the aridity of the accessible portions of the table-lands rendered the explorations difficult. Though the season of the year was the most favorable for finding water, much inconvenience was experienced from its scarcity, and it is doubtful whether, during the dry months, the examinations could have been prosecuted at all.

A discussion of the agricultural value of the region explored, or its capability of sustaining a population, would involve many considerations, some of an intricate character, a fair exposition of which would require a degree of detail much beyond the limits of the present communication. A few general facts and conclusions can only be stated.

During the explorations all of the lands upon the Colorado, from its mouth to the 36th parallel, and the greater portion of the region along both the 36th and 35th parallels between the Colorado and the Rio Grande, was traversed. Much of the country had been previously explored, and a considerable portion of it, particularly some of the open valleys of the Great and Little Colorado river, and the Navajoe country, pronounced by excellent authorities a good agricultural region, capable of a high degree of cultivation. Many facts were noticed during the examination that tended to confirm this view, but many unfavorable features were also apparent.

Of the valleys upon the Colorado, that of the Mojave Indians, which borders the 35th paral-

lel, is by far the finest, and is perhaps the most promising-looking region in the portion of New Mexico west of the Rio Grande. It was visited in the season of Spring, which, in that climate, is during the month of February. The atmosphere was indescribably balmy and delicious. A pale transparent haze of a peculiar delicate blue, which all must have noticed who have been in this valley, enveloped it with a softened glow. In brilliant contrast to the dark and frowning mountains on either side were groves of trees, with fresh and beautiful foliage, dotting the whole expanse of the foreground. Fields of wheat, corn, beans, pumpkins and melons, promising a luxuriant crop, met the eye in every direction. Comfortable houses and well-built granaries, overflowing with the last year's stores, testified to the provident affluence of the inhabitants, and the robust appearance of the people themselves, with their well-developed frames and solid, glossy limbs, betokened a high degree of health, comfort and good living. That, for the number of Indians who now inhabit it, with their habits and mode of life, the country is an excellent one, there can be no doubt. Whether it could ever be of much value to whites, admits of a great deal of doubt.

The shifting of the bed of the Colorado would be a source of great trouble in so narrow a valley. The changes occur with a rapidity and to an extent that can scarcely be appreciated by one who has not witnessed them. Having passed through the country in the spring of 1854, while accompanying the expedition of Lieutenant Whipple for the location of a railroad route along the 35th parallel, I had an opportunity of observing the effects of this action, which were so great as to justify the inference that every portion of the cultivable bottom lands is liable to be, in turn, overrun by the river. To the Indians, who have a certain community of property and interest, and no valuable improvements to lose, this is a matter of no vital moment; but the white settler would be much discouraged from putting up buildings and fences, and digging the ditches necessary for purposes of irrigation, by the knowledge that the river might at any day direct its course through his premises.

Freshets occur at periodical intervals, which subject large portions of the valley to inundation. Four or five months of the year the rays of the sun are so intense and burning that no vegetation can withstand their influence, and, during the very early spring, sometimes, when at midday there is an ordinary summer temperature, ice formed at night. The growing season is thus rendered exceedingly short, and a

single accident to a crop would, for that year, be without remedy. Seasons have occurred, within a few years, when the Mojaves have been subjected from this cause to great privations, and lost considerable numbers from actual starvation.

The composition of various portions of the soil was carefully examined by Dr. Newberry, the geologist of the expedition, and I am informed by him that though much of it is so constituted as to be fertile, very large tracts in the higher parts of the valleys are so impaired by an excess of alkaline substances as to be comparatively valueless.

In forming an opinion of the value of the region, some weight, too, should be attached to the fact that the races upon the river do not multiply. The records of the early Spanish explorers show a diminution rather than an increase of population since that period, and for this there is no assignable cause, unless it may be the incapacity of the country to sustain a large number of inhabitants. The Mojaves have had no communication with the whites, excepting when a wandering trapper, or some exploring party, has passed by their territory. A peaceful yet a powerful people, and guarded on all sides by difficult mountains, they have suffered but little from wars with other tribes. Their mode of life has conduced to the highest state of physical development. The marriage relation, as has been noticed by all who have been among them, is respected in more than an ordinary degree among the Indians, and there seems to be no reason, except that above stated, why they should not have become a numerous nation.

The remark made respecting this locality will apply, and perhaps in a stronger manner, to the rest of the country on the river, and also to the valley of the Little Colorado. The latter region abounds in ruins and vestiges of a former population, but is now uninhabited.

The remainder of the great area of territory examined, presents also its discouraging features. The northern portion is much the worst. Besides the deserts that have been alluded to, in the timbered region itself, are found broad tracts where the vegetation has become extinct, and the white and withered trunks are scattered, like monuments, over a vast cemetery of departed life. No indication of fire exists. The destruction has been gradual, and an impression is conveyed of some deadly rot slowly creeping over the surface of the country. Want of rain is undoubtedly the great cause of the evil. Near the abandoned ruins of several of the Moquis towns, no water can be found. This

people, though exposed to no contact with the whites, have partially dwindled away, and their ultimate fate, if the same meteorological condition continues, can be a question of little doubt.

Along the 35th parallel, within the limit of the volcanic disturbances, much of the country is better, and, at some seasons of the year, very attractive. After the melting snows of Spring, and during the autumnal rains, a more smiling picture of green forest glades, sparkling streams, verdant hills, and wild flowers, the eye could not desire to dwell upon; and excepting that the surface of the soil is in most places closely packed with lava rocks, there would seem to be a promising field for the agriculturist. Evidence, however, has been collected of seasons of drought so excessive as to render it doubtful whether more than a small portion of the country could ever be inhabited.

Over the whole of this region and that first alluded to, remains of buildings and fragments of pottery are found, and the fact has been adduced as an argument to establish the present capability of the country to sustain a population; but there is an analogy between these mouldering ruins and the dead forests near by suggestive of a different conclusion, giving rise to a doubt whether the decay of one race of inhabitants might not have been induced by influences that would be effectual to prevent the introduction of another.

The mineral resources of some parts of the country explored are considerable. The ranges of mountains that cross the navigable portion of the Colorado, which belong to the same system as those of California and Sonora, are like them the repositories of a large amount of mineral wealth. They were examined by Dr. Newberry with as great thoroughness and care as the character of the expedition would permit, and found to be traversed by veins of such magnitude and richness as to give promise of a field of extensive mining operations. The metals, as far as observed, were gold and mercury, in small quantity; silver, copper, and lead in rich and valuable deposits; and iron in the greatest abundance. The close proximity of the treasures of these mountains to water transportation, greatly enhances their value. A copper mine, that promises to be highly successful, is now being worked forty miles above Fort Yuma.

In the country of the upper Colorado, the useful minerals found were iron, coal, rock salt and marble. From their geographical position they have little pecuniary value, though their existence in that region is a fact of great scientific

interest. On the sides of the canons were splendid exposures of the stratified rocks which compose the great table lands of New Mexico, exhibiting all the formations from the base of the series to the tertiary.

GEOGRAPHY OF THE UNITED STATES OF AMERICA.

NO. 2

THE article in the January number of the Journal was confined to a description of the immediate valley of the Mississippi River. It is now proposed to extend this description to the great plain that lies between the western bank of this river and the Rocky Mountains.

The leading characteristics of this plain are—its extent; the regularity of its outlines; the uniformity of surface, aspect, and slope toward the Mississippi River; the high elevation of its western summit, and the similarity of the meteoric conditions of many portions of it.

Its extent and boundaries:

The Mississippi River, which forms its eastern boundary, has for its whole extent a southerly direction—by far the greater part of its course being near the meridian of 91° west from Greenwich. The river crosses this meridian at eight different points—upon the parallel of 42°; three times near the parallel of 41°; once near the parallel of 40°; once upon the parallel of 34°, and lastly upon that of 30°. It has its source under the meridian of 95°, and its outlet under that of 89°. The most considerable deviations, from a very direct southerly course, are near its source and mouth, near both of which it has an easterly course for nearly 200 miles. At the mouth of the Ohio it deflects easterly about 150 miles to receive that stream. With these exceptions, which seem to correspond to similar deviations in the Rocky Mountains from a northerly and southerly course, the general southerly direction of the river is remarkably uniform.

The western boundary of the great plain is the Rocky Mountains, embracing under this name the whole extent of the range drained by rivers falling into the Mississippi River. At